exposing a surface of the microelectronic workpiece to a plating solution including a principal metal species to be deposited;

applying plating power between the surface of the workpiece and an electrode disposed in contact with the plating solution to electrolytically deposit metal onto the surface, wherein plating power is applied:

at a first current density for a first period of time to deposit a first layer of the metal onto the surface of the workpiece; and subsequently

at a second current density for a second period of time to deposit a second layer of the metal onto the first layer of metal, wherein the second current density is substantially greater than the first current density and a majority of the metal deposited onto the surface of the workpiece is deposited during the second time period.

33. (New) The process of Claim 32, wherein the surface of the microelectronic workpiece defines a plurality of recessed microstructures, and the first current density and first period of time are selected to at least partially fill the recessed microstructures with the deposited metal.

34. (New) The process of Claim 33, wherein metal deposited during the first time period has a grain size that is sufficiently small to fill the recessed microstructures and at least some of the recessed microstructures have a width of less than or equal to 0.3 micron.

35. (New) The process of Claim 33, further comprising annealing the deposited metal after the second time period to increase a grain size defined by the metal.

36. (New) The process of Claim 35, wherein the metal is annealed at a temperature of less than 250° C.

37. (New) The process of Claim 32, wherein the first current density is about 3.2 mA/cm^2.

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38. (New) The process of Claim 32, wherein the second current density is about 20 mA/cm^2.

39. (New) The process of Claim 32, wherein a ratio of the second current density to the first current density is about 6:1.

40. (New) The process of Claim 32, wherein the first time period is about 30 seconds.

41. (New) The process of Claim 32, further comprising annealing the deposited metal after the second time period at a temperature of less than 250° C.

42. (New) The process of Claim 32, wherein metal is deposited at a higher rate during the second time period than during the first time period.

43. (New) The process of Claim 32, further comprising depositing a seed layer onto the surface of the microelectronic workpiece prior to the first time period, the first layer of metal being deposited onto the seed layer.

44. (New) A process for electrochemical deposition of copper onto a surface of a microelectronic workpiece, comprising:

exposing a surface of the microelectronic workpiece to a plating solution including copper as a principal metal species to be deposited;

applying plating power between the surface of the workpiece and an electrode disposed in contact with the plating solution to electrolytically deposit copper onto the surface, wherein plating power is applied:

at a first current density for a first period of time to deposit a first layer of copper onto the surface of the workpiece; and subsequently

at a second current density for a second period of time to deposit a second layer of copper onto the first layer of copper, wherein the second current density is substantially greater than the first current density and a majority of copper deposited onto the surface of the

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workpiece is deposited during the second time period.

45. (New) The process of Claim 44, wherein the second current density is applied immediately after the first period of time.

46. (New) A process for electrochemical deposition of metal onto a surface of a microelectronic workpiece, the surface defining a plurality of recessed microstructures, comprising:

exposing a surface of the microelectronic workpiece to a plating solution including a principal metal species to be deposited;

applying plating power between the surface of the workpiece and an electrode disposed in contact with the plating solution to electrolytically deposit metal onto the surface, wherein plating power is applied:

at a first current density for a first period of time to deposit a first layer of the metal onto the surface of the workpiece to at least partially fill the recessed microstructures; and subsequently

at a second current density for a second period of time to deposit a second layer of the metal onto the first layer of metal, wherein the second current density is substantially greater than the first current density.

47. (New) The process of Claim 46, wherein the second current density is applied immediately after the first period of time has elapsed.

48. (New) A process for electrochemical deposition of metal onto a surface of a microelectronic workpiece, comprising:

applying a metal seed layer onto a surface of the microelectronic workpiece;

exposing the surface of the microelectronic workpiece to a plating solution including a principal metal species to be deposited;

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applying plating power between the surface of the workpiece and an anode disposed in contact with the plating solution to electrolytically deposit metal onto the surface, wherein plating power is applied:

at a first current density for a first period of time to deposit a first layer of the metal onto the seed layer on the surface of the workpiece; and subsequently

at a second current density for a second period of time to deposit a second layer of the metal onto the first layer of metal, wherein the second current density is substantially greater than the first current density.

49. (New) A method of depositing a metal layer on a semiconductor wafer, comprising:

depositing a seed layer on a surface of the wafer;

immersing the wafer in an electrolytic solution containing metal ions;

electrolytically depositing a first plated layer on the wafer by applying current at a first current density between the wafer and the solution; and

after a first period of time during which the first plated layer has been formed, increasing the applied current to a second current density greater than the first current density to plate additional metal onto the first plated layer.

50. (New) An apparatus for use in electrochemical deposition of metal onto a surface of a microelectronic workpiece, comprising:

a reactor that receives a surface of the microelectronic workpiece in a chamber in which the surface of the microelectronic workpiece is exposed to a plating solution including a principal metal species to be deposited;

an electrode disposed in contact with the plating solution; and

a source of plating power supplied between the anode and the surface of the

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microelectronic workpiece to deposit metal from the plating solution onto the surface of the microelectronic workpiece, wherein the source of plating power is operated to supply power at a first current density for a first period of time to deposit a first layer of metal onto the surface of the workpiece, and then at a second current density for a second period of time to deposit a second layer of metal onto the first layer of metal, and wherein the second current density is substantially greater than the first current density and the majority of metal is deposited onto the surface of the workpiece during the second time period.

51. (New) An apparatus for use in electrochemical deposition of metal onto a surface of a microelectronic workpiece including recessed microstructures, comprising:

a reactor that receives a surface of the microelectronic workpiece in a chamber in which the surface of the microelectronic workpiece is exposed to a plating solution including a principal metal species to be deposited;

an electrode disposed in contact with the plating solution; and

a source of plating power connected between the anode and the surface of the microelectronic workpiece to deposit metal from the plating solution onto the surface of the microelectronic workpiece to at least partially fill the recessed microstructures, wherein the source of plating power supplies power at a first current density for a first period of time to deposit a first layer of metal onto the surface of the workpiece, and subsequently supplies power at a second current density for a second period of time to deposit a second layer of metal onto the first layer of metal, and wherein the second current density is substantially greater than the first current density.

52. (New) An apparatus for use in electrochemical deposition of metal onto a surface of a microelectronic workpiece, comprising:

reactor means for receiving a surface of the microelectronic workpiece in a chamber in

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which the surface of the microelectronic workpiece is exposed to a plating solution including a principal metal species to be deposited;

an electrode disposed in contact with the plating solution; and

means for supplying plating power between the anode and the surface of the microelectronic workpiece to deposit metal from the plating solution onto the surface of the microelectronic workpiece, wherein the means for supplying plating power supplies power at a first current density for a first period of time to deposit a first layer of metal onto the surface of the workpiece, and subsequently supplies power at a second current density for a second period of time to deposit a second layer of metal onto the first layer of metal, and wherein the second current density is substantially greater than the first current density and the majority of metal is deposited onto the surface of the workpiece during the second time period.

53. (New) A process for electrochemical deposition of material onto a surface of a microelectronic workpiece, comprising:

exposing a surface of the microelectronic workpiece to a solution including a material to be deposited;

applying plating power between the surface of the workpiece and an electrode disposed in contact with the solution to electrolytically deposit material onto the surface, wherein plating power is applied:

at a first current density for a first period of time to deposit a first layer of the material onto the surface of the workpiece; and subsequently

at a second current density for a second period of time to deposit a second layer of the material onto the first layer of material, wherein the second current density is substantially greater than the first current density and a majority of the material deposited onto the surface of the workpiece is deposited during the second time period.

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